

### REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-4, 7-11, and 14-34 are currently pending. Claims 1, 2, 4, 7-9, 11, 14-16, 18 and 21-28 have been amended by the present amendment. The changes to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 1 and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,995,581 to Ozaki (hereinafter “the ‘581 patent”) in view of U.S. Patent No. 6,760,468 to Yeh et al. (hereinafter “the ‘468 patent”); Claims 7, 14, 19, 20, 23, and 26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,549,645 to Oikawa et al. (hereinafter “the ‘645 patent”) in view of the ‘468 patent; Claims 2-4 and 22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over International Publication No. WO 02/43801 to Wang (hereinafter “the ‘801 patent”) in view of U.S. Patent No. 7,103,205 to Wang et al. (hereinafter “the ‘205 patent”), further in view of the ‘468 patent and U.S. Patent No. 7,313,259 to Alyassin et al. (hereinafter “the ‘259 patent”); Claims 8, 15, 24, and 27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘518 and ‘468 patents in view of the Aird et al. reference (“CT Simulation for Radiotherapy Treatment Planning”); Claims 9-11, 16-18, 25, and 28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘801, ‘468, ‘259, and ‘205 patents, further in view of the Aird et al. reference; Claims 29 and 32 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘801, ‘468, ‘259, and ‘205 patents, further in view of U.S. Patent No. 7,295,691 to Uppaluri et al. (hereinafter “the ‘691 patent”); and Claims 30, 31, 33, and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘801, ‘468, ‘259, and ‘205 patents, further in view of the Aird et al. reference and the ‘691 patent.

Applicants wish to thank the Examiner for the interview granted Applicants' representative on August 26, 2010, at which time proposed amendments to Claims 1 and 2 were discussed. At the conclusion of the interview, the Examiner agreed that the proposed amendments to Claims 1 and 2 appear to overcome the outstanding rejection of those claims.

Amended Claim 1 is directed to a computer aided diagnostic system, comprising: (1) a sick portion detecting device configured to detect a lung cancer candidate as a sick portion candidate by automatically extracting a lung field based upon a simple X-ray image acquired by a first modality, and extracting the lung cancer candidate in the lung field; and (2) a correspondence displaying device configured to automatically determine an X-ray CT image of a plurality of X-ray CT images acquired by a second modality different from the first modality that corresponds to a position of the detected sick portion candidate, and to display the determined X-ray CT image having an axial face and including a mark that corresponds to the position of the lung cancer candidate displayed on the simple X-ray image. The changes to Claim 1 are supported by the originally filed specification and do not add new matter.<sup>1</sup>

Regarding the rejection of Claim 1 under 35 U.S.C. § 103(a), the Office Action asserts that the '581 patent discloses everything in Claim 1 with the exception that the specific portion candidate is a lung cancer candidate that is detected by automatically extracting a lung field, and relies on the '468 patent to remedy that deficiency.

The '581 patent is directed to an X-ray diagnostic system including an X-ray fluoroscopy apparatus providing a computed radiography image composed of digital pixel values produced from X-rays transmitted through an object subjected to fluoroscopic X-rays. In particular, the '581 patent discloses that a slice position of the object as the positional

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<sup>1</sup> See, e.g., pages 26-28 in the specification, as well as Figures 8 and 9 and the discussion related thereto in the specification.

information required for the X-ray CT scanner is obtained and provided for the X-ray CT scanner using this system.

However, the Office Action [admits] that the '581 patent fails to disclose a sick portion detecting device configured to detect a lung cancer candidate as a sick portion candidate by automatically extracting a lung field based upon a simply X-ray image acquired by a first modality, and extracting the lung cancer candidate in the lung field, as recited in amended Claim 1.

Further, Applicants respectfully submit that the '581 patent fails to disclose a correspondence displaying device configured to automatically determine an X-ray CT image of a plurality of X-ray CT images that corresponds to a portion of the detected sick portion candidate and to display the determined X-ray CT image having an axial face and including a mark that corresponds to the position of the lung cancer candidate displayed on the simple X-ray image, as recited in amended Claim 1. Applicants respectfully submit that the '581 patent is silent regarding selecting automatically one of the X-ray CT images and displaying the determined X-ray CT image including a mark that corresponds to the position of the lung cancer candidate that was displayed on the simple X-ray image, as recited in amended Claim 1.

The '468 patent is directed to a method for improved detection of abnormalities, such as lung nodules, in radiological images using digital image processing and artificial neural network techniques.

However, Applicants respectfully submit that the '468 patent fails to disclose a correspondence displaying device to automatically determine an X-ray CT image of a plurality of X-ray CT images that correspond to a portion of the detected sick portion candidate, and to display a determined X-ray CT image including a mark that corresponds to

the position of the lung cancer candidate displayed on the simple X-ray image, as recited in amended Claim 1.

Thus, no matter how the teachings of the '581 and '468 patents are combined, the combination does not teach or suggest the correspondence displaying device recited in amended Claim 1. Accordingly, Applicants respectfully submit that the rejection of Claim 1 is rendered moot and that Claim 1 patentably defines over any proper combination of the '581 and '468 patents.

Independent Claim 21 recites limitations analogous to the limitations recited in Claim 1 and has been amended in a manner analogous to the amendment to Claim 1. Accordingly, for the reasons state above, Applicants respectfully submit that the rejection of Claim 21 is rendered moot by the present amendment to that claim.

Amended Claim 7 is directed to a computer-aided diagnostic system, comprising: (1) a sick portion detecting device configured to detect a lung cancer candidate as a sick portion candidate by automatically extracting a lung field based upon an X-ray CT image acquired by one modality, and extracting the lung cancer candidate in the lung field; (2) an image transforming device configured to transform volume image data acquired by the one modality into a digitally reconstructed radiograph using a selected viewpoint; and a (3) correspondence displaying device configured to automatically determine a position of the lung cancer candidate detected by the sick portion detecting device to the digitally reconstructed radiograph and to display the digitally reconstructed radiograph including a mark that corresponds to the position of the lung cancer candidate displayed on the X-ray CT image having an axial face. The changes to Claim 7 are supported by the originally filed specification and do not add new matter.

Regarding the rejection of Claim 7 under 35 U.S.C. § 103(a), the Office Action asserts that the '645 patent discloses everything in Claim 7 with the exception of a sick

portion candidate being a lung cancer candidate that is detected automatically by detecting a lung field, and relies on the '468 patent to remedy that deficiency.

The '645 patent is directed to an image processing method including generating three dimensional data, calculating a second version of three dimensional data by calculating a standard deviation of the three dimensional data; setting radiation conditions; interpolating voxel values of the second version of the three dimensional data on a ray irradiated from a radiation source; generating a digitally reconstructed radiograph by adding up the voxel values interpolated along the ray; and displaying the generated digitally reconstructed radiograph.

However, the Office Action admits that the '645 patent fails to disclose a sick portion detecting device configured to detect a lung cancer candidate as a sick portion candidate by automatically extracting a lung field based upon an X-ray CT image acquired by one modality, and extracting the lung cancer candidate in the lung field.

Further, Applicants respectfully submit that the '645 patent fails to disclose a correspondence displaying device configured to automatically determine a position of the lung cancer candidate in the digitally reconstructed radiograph and to display the digitally reconstructed radiograph including a mark that corresponds to the position of the lung cancer candidate displayed on the X-ray CT image, as recited in amended Claim 7. Applicants respectfully submit that the '645 patent is silent regarding determining a position of a lung cancer candidate detected from an X-ray CT image in a digitally reconstructed radiograph and displaying the digitally reconstructed radiograph including a mark corresponding to the position of the lung cancer candidate displayed on the X-ray CT image, as required by Claim 7.

As discussed above, the '468 patent is directed to a method and system for detecting abnormalities such as lung nodules in radiological images. However, Applicants respectfully

submit that the '468 patent fails to remedy the deficiencies of the '645 patent discussed above. In particular, Applicants respectfully submit that the '468 patent fails to disclose a correspondence displaying device configured to automatically determine a position of the lung cancer candidate in the digitally reconstructed radiograph and to display the digitally reconstructed radiograph including a mark that corresponds to the position of the lung cancer candidate displayed on the X-ray CT image, as recited in amended Claim 7.

Thus, no matter how the teachings of the '645 and '468 patents are combined, the combination does not teach or suggest the correspondence displaying device recited in amended Claim 7. Accordingly, Applicants respectfully submit that the rejection of Claim 7 is rendered moot and that Claim 7 patentably defines over any proper combination of the '645 and '468 patents.

Independent Claims 14, 23, and 26 recite limitations analogous to the limitations recited in Claim 7, and have been amended in a manner analogous to the amendment to Claim 7. Accordingly, for the reasons stated above, Applicants respectfully submit that the rejections of Claims 14, 23, and 26 (and all associated dependent claims) are rendered moot by the present amendment to Claims 14, 23, and 26.

Amended Claim 22 is directed to a computer aided diagnosing method, comprising:  
(1) detecting a first lung cancer candidate as a first sick portion candidate by automatically extracting a first lung field based upon a simple X-ray image acquired by a first modality, and extracting the first lung cancer candidate in the first lung field; (2) detecting a second lung cancer candidate as a second sick portion candidate by automatically extracting a second lung field based upon an X-ray CT image related to the same region of interest of the same subject acquired by a second modality different from the first modality, and extracting the second lung cancer candidate in the second lung field; and (3) comparing the results of detection at the first and second detecting and automatically determining whether the first lung cancer

candidate corresponds to the second lung cancer candidate, wherein positions of the first and second lung cancer candidates respectively detected from the simple X-ray image and the X-ray CT image are compared. The changes to Claim 22 are supported by the originally filed specification and do not add new matter.<sup>2</sup>

Regarding the rejection of Claim 22 under 35 U.S.C. § 103(a), the Office Action asserts that the '801, '205, and '259 patents disclose everything in Claim 22 with the exception of the sick portion candidates being lung cancer candidates that are detected by automatically extracting a lung field, and relies on the '468 patent to remedy those deficiencies.

However, Applicants respectfully submit that no matter how the teachings of the '801, '205, '259, and '468 patents are combined, the combination does not teach or suggest comparing the results of the first and second detecting, and automatically determining whether the first lung cancer candidate corresponds to the second lung cancer candidate, as recited in amended Claim 22. In particular, Applicants note that the '468 patent merely discloses detecting abnormalities such as lung nodules in radiological images using digital image processing. Further, the '259 patent is directed to a method for multi-modality registration using virtual cursors. However, Applicants respectfully submit that the '259 patent fails to disclose automatically determining whether a first lung cancer candidate corresponds to a second lung cancer candidate, the first lung cancer candidate being obtained in a simple X-ray image and the second lung cancer candidate being obtained from an X-ray CT image.

Further, Applicants note that the '801 patent is directed to a breast cancer screening system, while the '205 patent is also directed to a method for facilitating the detection of abnormalities in the breast using X-ray and ultrasound imaging. However, Applicants

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<sup>2</sup> See, e.g., page 23 of the specification.

respectfully submit that both the '801 and '205 patents are completely silent regarding the detecting of lung cancer candidates and automatically extracting a lung field, as required by amended Claim 22.

Further, Applicants note that the '801 patent is directed to the use of an ultrasonic system for the diagnosis of breast cancer, but that an ultrasonic system would not be used for the diagnosis of a lung field. In particular, Applicants note that it is well known that there are disincentives for using ultrasound for the lung field, due to the inappropriate size of the lung field and reflection of ultrasonic waves from ribs. Thus, Applicants respectfully submit that there will be no motivation for one of ordinary skill in the art to modify the teachings of the '205 patent for extracting a lung field.

Accordingly, for the reasons stated above, Applicants respectfully submit that the rejection of Claim 22 is rendered moot by the present amendment to that claim.

Claim 2 recites limitations analogous to the limitations recited in Claim 22 and has been amended in a manner analogous to the amendment to Claim 22. Accordingly, for the reasons stated above, Applicants respectfully submit that the rejection of Claim 2 is rendered moot by the present amendment to that claim.

Amended Claim 8 is directed to a computer-aided diagnostic system, comprising: (1) an image transforming device configured to transform volume image data acquired by one modality into a digitally reconstructed radiograph using a selected viewpoint; (2) a sick portion detecting device configured to detect a lung cancer candidate as a sick portion candidate by automatically extracting a lung field based upon the digitally reconstructed radiograph, and extracting the lung cancer candidate in the lung field; (3) and a correspondence displaying device configured to automatically determine an X-ray CT image acquired by the one modality that corresponds to a position of the detected lung cancer candidate and to display the determined X-ray CT image having an axial face and including a



mark that corresponds to the position of the lung cancer candidate displayed on the digitally reconstructed radiograph. The changes to Claim 8 are supported by the originally filed specification and do not add new matter.

In particular, Applicants note that Claim 8 has been amended to recite limitations analogous to the limitations recited in Claim 1.

Applicants respectfully submit that the rejection of Claim 8 is rendered moot by the present amendment to that claim. In particular, Applicants respectfully submit that, no matter how the teachings of the '581 patent, the '468 patent, and the Aird et al. reference are combined, the combination does not teach or suggest a correspondence displaying device configured to automatically determine an X-ray CT image required by the one modality that corresponds to a position of the detected lung cancer candidate as to display the determined X-ray CT image having an axial face and including a mark that corresponds to the position of the lung cancer candidate displayed on the digitally reconstructed radiograph, as recited in amended Claim 8. As discussed above, the '581 and '468 patents fail to disclose this limitation. Further, Applicants note that the Aird et al. reference is directed to the use of a CT device for radiotherapy treatment and for a full 3D viewing and planning of a patient. However, the Aird et al. reference is silent regarding automatically determining an X-ray CT image acquired by one modality that corresponds to a position of the detected lung cancer candidate and to display the determined X-ray CT image including a mark that corresponds to a position of the lung cancer candidate, as required by Claim 8. Accordingly, for the reasons state above, Applicants respectfully submit that the rejection of Claim 8 is rendered moot by the present amendment to that claim.

Independent Claims 15, 24, and 27 recite limitations analogous to the limitations recited in Claim 8, and have been amended in a manner analogous to the amendment to Claim 8. Accordingly, for the reasons stated above, Applicants respectfully submit that the

rejections of Claims 15, 24, and 27 are rendered moot by the present amendment to those claims.

Claim 9 is directed to a computer-aided diagnostics system, comprising: (1) a first sick portion detecting device configured to detect a first lung cancer candidate as a first sick portion candidate by automatically extracting a first lung field based upon an X-ray CT image acquired by one modality, and extracting the first lung cancer candidate in the first lung field; (2) an image transforming device configured to transform volume image data acquired by the one modality into a digitally reconstructed radiograph using a selected viewpoint; (3) a second sick portion detecting device configured to detect a second lung cancer candidate as a second sick portion candidate by automatically extracting a second lung field based upon the digitally reconstructed radiograph, and extracting the second lung cancer candidate in the second lung field; (4) and a detection result synthesizing device configured to compare the results of detection by the first and second sick portion detecting devices and to determine automatically whether the first lung cancer candidate corresponds to the second lung cancer candidate, wherein the detection result synthesizing device compares positions of the first and second lung cancer candidates respectively detected from the X-ray CT image and the digitally reconstructed radiograph. The changes to Claim 9 are supported by the originally filed specification and do not add new matter.

As discussed above, the combined teachings of the '801, '205, '468, and '259 patents fail to disclose and to determine automatically whether the first lung cancer candidate corresponds to the second lung cancer candidate, as recited in amended Claim 9. Also, as discussed above, the Aird et al. reference fails to remedy that deficiency. Accordingly, Applicants respectfully submit that, no matter how the teachings of the '205 patent, the '468 patent, the '259 patent, the '801 patent, and the Aird et al. reference are combined, the combination does not teach or suggest determining automatically whether the first lung

cancer candidate corresponds to the second lung cancer candidate, as recited in amended Claim 9. Accordingly, Applicants respectfully submit that the rejection of Claim 9 is rendered moot by the present amendment to that claim.

Independent Claims 16, 25, and 28 recite limitations analogous to the limitations recited in Claim 9, and have been amended in a manner analogous to the limitations to Claim 9. Accordingly, for the reasons stated above, Applicants respectfully submit that the rejections of Claims 16, 25, and 28 are rendered moot by the present amendment to those claims.

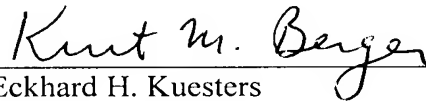
Regarding the rejection of dependent Claims 29-34 under 35 U.S.C. § 103(a), Applicants respectfully submit that the '691 patent fails to cure the deficiencies of the other cited references, as discussed above. Accordingly, for the reasons stated above, Applicants respectfully submit that the rejections of dependent Claims 29-34 are rendered moot by the present amendment to the independent claims.

Thus, it is respectfully submitted that Claims 1, 2, 7-9, 14-16, and 21-28 (and all associated dependent claims) patentably define over any proper combination of the cited references.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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A handwritten signature in cursive script, reading "Kurt M. Berger", is written over a horizontal line.

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